PATENT APPLICATION
Attorney Docket: 70021172-1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

Applicant:	Hataguchi, et al
Serial No.:	10/725,696
Filed:	12/1/2003
For:	Encoder Utilizing a Reflective Cylindrical Surface
Group Art Unit:	2878
Examiner:	Wyatt, Kevin

BRIEF FOR APPELLANT

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the decision of the Primary Examiner dated 2/8/2007, finally rejecting Claims 1-8 in the above-identified patent application.

I. REAL PARTY IN INTEREST

The real party in interest is Avago Technologies, LTD having an address as shown below.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in this pending appeal.

III. STATUS OF THE CLAIMS

Claims 1-8 are currently pending in the above-identified patent application. In the Office Action dated 2/8/2007, the Examiner rejected Claims 1-8 and indicated that the Action was final.

IV. STATUS OF AMENDMENTS

No amendments have been filed in this application since the above-described rejection.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed to a drum encoder for measuring the position of a rotating shaft by means of light reflecting off a track of stripes on a cylindrical surface of a drum rotating about that same shaft or about an axis coupled to that shaft.

With respect to Claim 1, refer to Figures 3 and 4, and the discussion thereof beginning on line 21 on page 4 of the present application. Figure 3 shows the drum 22 with an axis 21, and an encoding track made up of non-reflecting stripes 23 and reflecting stripes, the reflecting stripes having an outer circular cylindrical surface whose axis is coincident with the axis of the drum. Figure 4 shows the detector module 25, which includes a light source 26 and a photodetector 27. The light source illuminates the encoding track of stripes 23 at an oblique angle relative to the normal to the surface of the drum on which the stripes lie. The photodetector is positioned so that, as the drum rotates relative to the detector, an image of the reflective stripes is formed on the photodetector, with a magnification that depends on the radius of curvature of the drum. Figure 5 and the discussion thereof beginning on line 32 on page 4 give more details regarding the image formation.

Claim 2 includes the same limitations as Claim 1 and additionally requires that the light leaving the light source 26 is a collimated beam. Claim 3 depends from Claim 1 and also specifies that the drum rotate about its axis when a shaft is rotated. Claim 4 depends from Claim 3 and additionally requires that the axis of the shaft is coincident with the axis of the drum.

Claim 5 requires the same limitations noted above with respect to Claim 1 and also specifies the physical arrangement shown in Figures 1 and 2, where the stripes lie on the outer surface of the drum. Claim 6 relates to another implementation, as shown in Figure 6, where the stripes lie on the inner surface of the drum.

With respect to Claim 7, refer to Figure 8, which shows an implementation of the invention limited by Claim 1 with the extra limitation of having two tracks, 42 and 43, each of reflecting and non-reflecting stripes, illuminated by corresponding light sources 47 and 48. Claim 8 depends from Claim 7 and additionally requires that the widths of the reflective stripes in the two tracks are different, as shown in Figure 8, enabling the encoder to provide an absolute measurement of angular position, rather than just an incremental measurement.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Rejection of Claims 1 and 5 under 35 U.S.C. 102(e) as being anticipated by Rothamel (US 6,639,206 B1).

B. Rejection of Claim 2 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Chen (US 6,817,528 B2).

C. Rejection of Claims 3 and 4 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Suganuma (US 6,448,996 B2).

D. Rejection of Claim 6 under 35 U.S.C. 103(a) as being unpatentable over Rothamel.

E. Rejection of Claim 7 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Karim-Panahi (US 5,438,882).

F. Rejection of Claim 8 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Karim-Panahi and Cohen (US 4,124,839).

VII. ARGUMENT

A. Examiner's Burden under 35 U.S.C. 102

The Examiner has the burden of showing by reference to the cited art each claim limitation in the reference. Anticipation under 35 U.S.C. 102 requires that each element of the claim in issue be found either expressly or inherently in a single prior art reference. In re King, 231 USPQ 136, 138 (Fed. Cir. 1986); Kalman v. Kimberly-Clark Corp., 218 USPQ 781, 789 (Fed. Cir. 1983). The mere fact that a certain thing may result from a given set of

circumstances is not sufficient to sustain a rejection for anticipation. *Ex parte Skinner*, 2 USPQ2d 1788, 1789 (BdPatApp&Int 1986). "When the PTO asserts that there is an explicit or implicit teaching or suggestion in the prior art, it must indicate where such a teaching or suggestion appears in the reference" (*In re* Rijckaert, 28 USPQ2d, 1955, 1957).

B. Examiner's Burden under 35 U.S.C. 103

To sustain a rejection under 35 U.S.C. 103, the Examiner must show that the combined references teach each of the elements of the claim or that there is some motivation in the art for altering one of the teachings to arrive at the combined set of teachings. "The mere fact that a reference could be modified to produce the patented invention would not make the modification obvious unless it is suggested by the prior art." (*Libbey-Owens-Ford v. BOC Group*, 4 USPQ 2d 1097, 1103). In addition, the Examiner must show that there is some motivation in the art that would cause someone of ordinary skill to combine the references, and that in making the combination, there was a reasonable expectation of success. Where the claimed subject matter has been rejected as obvious in view of a combination of prior art references, a proper analysis under section 103 requires, *inter alia*, consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should make the claimed composition or device, or carry out the claimed process; and (2) whether the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. *In re Vaeck*, 20 USPQ2d 1438, 1442(CAFC 1991).

C. Rejection of Claims 1-8

1. Rejection of Claims 1 and 5 under 35 U.S.C. 102(e) as being anticipated by Rothamel

Applicant submits that the encoder taught by Rothamel fails to conform to three limitations of Claim 1 and Claim 5. First, these Claims require an image of each reflective stripe to be formed on the photodetector. Second, these claims require that the image have a magnification that depends on the radius of curvature of the circular cylindrical surface.

Third, these Claims require that the reflective stripes have an outer circular cylindrical surface whose axis is coincident with the axis of the drum.

The Examiner looks to Figures 1, 2, 6 and 7 of Rothamel, identifying surface 5 as the cylindrical surface recited in the claim and element 9 as the first track having reflective stripes 2 and non-reflective stripes 11.

The Examiner states that the device taught in Rothamel forms an image of the reflective stripes on the photodetector 3 and that the image has a magnification that depends on the radius of curvature of the cylindrical surface. Applicant submits that, to the contrary, in the encoder of Rothamel, no image of the reflective stripes is formed on the photodetector, no less an image having a magnification that depends on the drum diameter.

First, in each embodiment of the encoder of Rothamel, shown in the figures pointed to by the Examiner, the light source is focused to a point on the reflector surface. Rothamel makes this very clear in the accompanying text, in column 5 line 3 for Figure 1, and in column 5 line 61 for Figures 6 and 7. When the reflector is at the correct point in the rotation of the drum, the reflected light enters the photodetector. Applicant submits that the only image formed on the detector is therefore an image of the light source, as taught by Rothamel. In this regard, it should be noted that the Examiner admits that Rothamel teaches an apparatus in which a detailed image of he light source is reflected from the surface reflectors. (Page 6, first paragraph of office action dated 7/14/2006). In this regard, it should be noted that at any given time each stripe is only illuminated at the single point on that stripe at which the light beam is focused on that stripe. Hence, an image could not be formed, since the entire stripe is not illuminated. Hence, Applicant submits that the limitation in Claims 1 and 5 that an image of the reflective stripes is formed is not taught by Rothamel.

Second, Applicant submits that the image of the source does not change in shape or size as a function of the curvature of the drum. Rothamel teaches embodiments in which the reflectors on the surface of the drum are flat, convex or concave. In the first case, the radius of curvature of the reflector is infinite, and hence, could not depend on the curvature of the drum. In the remaining two cases, it is clear from the drawings that the curvature of the

reflectors is not related to the curvature of the drum but rather to the optics in the light source and detector. The Examiner has not pointed to any teaching in Rothamel that there is a relationship between the radius of curvature of the convex and concave reflectors and the radius of curvature of the drum on which these reflectors are placed.

The Examiner attempts to overcome this problem by asserting that the magnification inherently depends on the radius of curvature of whatever is being imaged. First, as noted above, it is the light source that is being imaged, and the light source has no "radius of curvature". Second, the radius of curvature in question is the radius of curvature of the drum, not the radius of curvature of the reflector. The Examiner has not pointed to any teaching in Rothamel that the radius of curvature of the reflectors on the drum is related to the radius of curvature of the drum.

Hence, Applicant submits that the limitation that an image of the reflective stripes is formed with a magnification that depends on the radius of curvature of the drum is not taught by Rothamel.

Third, the Examiner points to Figure 1 as showing that the stripes are contoured to the shape of the drum. First, the level of detail that is available in Figure 1 is insufficient to determine if the stripes are flat surfaces as shown in Figure 4 or contoured to the surface of the drum as asserted by the Examiner. Second, all of the examples provided in the reference utilize a stripe pattern in which the surface of the stripes is not coincident with the surface of the drum. "It is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue" *Nystrom v. Trex Co.*, 71 USPQ2D 1241, 1250. Hence, Applicant submits that Rothamel does not teach the limitation of the stripes being contoured to the shape of the drum.

Accordingly, Applicant submits that Claims 1 and 5 are not anticipated by Rothamel.

2. Rejection of Claim 2 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Chen.

Claim 2 includes the limitations of Claim 1 and a further limitation that the light source emits a collimated beam of light. The Examiner admits that Rothamel does not teach this additional limitation. The Examiner looks to Chen for the missing teachings. First, Chen does not teach the missing teachings with respect to the limitations of Claim 1.

The Examiner states that Rothamel teaches all the limitations of Claim 2 except for the requirement that the light source emits a collimated beam of light. The Examiner looks to Chen for the missing teachings. The Examiner maintains that it would have been obvious to use the teachings of Chen in the device taught by Rothamel to collimate light from the source "for the purpose of maintaining alignment of active lighting area with the area of photodetector during drum rotation". The Examiner doe not point to any place in the art at which one can find a suggestion that replacing the light source taught in Rothamel with a collimated light source would lead to the Examiner's asserted improvement or how this improvement would be obtained.

The device taught in Chen senses changes in the relative positions of two encoding tracks by utilizing Moire fringes. As such the tracks are preferably illuminated with collimated light to provide the fringe pattern. The Examiner has not pointed to any teaching in Chen that the collimated beams are the source of any improvement in alignment. Chen faults prior art methods for measuring relative torque by measuring the relative shifts in the phase of two different encoding patterns placed at two different locations on a drum as being too sensitive to alignment errors with respect to the two encoding patterns used to measure shifts, not with respect to errors in the illumination of the two patterns. The improvements provided in Chen are the result of the use of Moire patterns to measure the relative shifts rather than the use of collimated light per se. Rothamel does not utilize any form of Moire pattern detection scheme. Hence, Applicant fails to see anything of relevance in the Examiner's citation of Chen other than the fact that collimated light illumination is known.

As noted above, the encoder taught in Rothamel requires the light source to be focused to a point on the reflector. The Examiner's proposed change would lead to a device in which the reflectors were uniformly illuminated by a collimated beam of light. Hence, the change proposed by the Examiner would lead to an inoperative device.

In addition, the Examiner has not pointed to any teaching as to how the collimation of the light from light source 1 taught in Rothamel would lead to maintaining the alignment of the active lighting areas taught in Rothamel with the photodetectors during drum rotation. The alignment between the light source and the detector is provided by the housing in which these elements are mounted. The stripes run the length of the drum; hence, there is no alignment issue along the axis of the drum. The drum turns such that the alignment of the stripes continually changes such that the stripes are continually moving into and out of "alignment" in the orthogonal direction. The Examiner has not pointed to any teaching that alignment errors are a problem or that providing a collimated beam in the light source of Rothamel would reduce alignment errors on the photodetector. Hence, Applicant also submits that the Examiner motivation for combining the teachings is flawed.

The Examiner attempts to overcome the lack of an expectation of success in making the combination proposed by the Examiner by pointing to Claim 2 of the current application as providing proof that the Examiner's proposed combination would be expected to operate in an improved manner. The present application is not part of the prior art on which the Examiner can rely on satisfying the Examiner's burden of proof.

Hence, Applicant submits the Examiner has not made a *prima facie* case for obviousness with respect to Claim 2.

3. Rejection of Claims 3 and 4 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Suganuma

Claims 3 and 4 depend from Claim 1. As noted above, Rothamel fails to teach three of the limitations recited in Claim 1. The Examiner has not pointed to any teaching in Suganuma that provides the missing teachings. Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claims 3 and 4.

4. Rejection of Claim 6 under 35 U.S.C. 103(a) as being unpatentable over Rothamel

Claim 6 depends from Claim 1 and adds the additional limitation that the track lies between the cylindrical surface and the axis of rotation, i.e., that the track is on the inside surface of the drum. The Examiner admits that Rothamel dies not provide the missing teaching. The Examiner suggests that making this modification would be obvious because providing an arrangement where the components operate from within the drum would allow the device to be manufactured at a smaller size.

First, as noted above with respect to Claim 1, Rothamel does not teach a number of the limitations of Claim 1. The Examiner has not pointed to any motivation to alter the teachings of Rothamel to arrive at a device that satisfies these missing limitations.

Second, Applicant submits that moving the source/detector package to the inside of the drum presupposes that the drum is, or can readily be made to be hollow, with the cavity accessible from one end, and still function properly. The Examiner has not pointed to any teaching in Rothamel suggesting that this presupposition is valid. Applicant also submits that even in cases where it is possible to do so, moving the source/detector package to the inside of the drum would involve creating a structure to maintain the position of the package independently of the rotational motion of the drum around it. Such a structure would not necessarily lead to an overall device size any smaller than the one taught by Rothamel.

Hence, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 6.

5. Rejection of Claim 7 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Karim-Panahi (US 5,438,882)

Claim 7 depends from Claim 1 and, in addition, requires a second track having reflective stripes on the same circular cylindrical surface with a second light source and photodetector. The Examiner admits that Rothamel does not teach such an arrangement. The Examiner looks to Karim-Panahi as providing the teaching of two tracks on the same surface. The Examiner maintains that it would be obvious to add the second track as taught by Karim-Panahi to the encoder of Rothamel because it would provide more data on the periodic motion of the drum.

First, as noted above with respect to Claim 1, Rothamel fails to teach limitations regarding the formation of an image of the stripes with magnification dependent on the radius of curvature of the underlying surface, and the stripes forming part of the circular cylindrical surface of the drum. These limitations are recited in Claim 1 from which Claim 7 depends. Karim-Panahi does not provide the missing teachings.

Second, the Examiner maintains that it would have been obvious to one skilled in the art to provide in Rothamel a second track of alternating reflective and non-reflective stripes, a second light source and a second photodetector, as taught by Karim-Panahi, for the purpose of collecting more data on the periodic motion of the rotating member. Applicant disagrees. Karim-Panahi teaches using a second track and a processing system for the purpose of detecting phase shifts between the two tracks to detect distortion of the shaft about which the tracks rotate. The purpose of the apparatus taught by Rothamel is to provide information on angular position in a plane normal to the axis of a rotating shaft, not information on distortion of a rotating shaft. The addition of a second track as taught in Karim-Panahi is of no use in the apparatus of Rothamel since it cannot provide additional angular position information absent some additional teachings, which the Examiner has failed to identify.

The Examiner's proposition depends on there being a measurable distortion along the axis of the drum taught in Rothamel. The Examiner has not pointed to any teaching in Rothamel that such a distortion exists. Second, if one were to place two tracks along the axis of the drum taught in Rothamel and determine that there is a relative shift between the tracks, it is not clear how one would use that information to provide a better position measurement in the device taught in Rothamel. One still does not which track provides the more accurate data. The Examiner attempts to overcome this problem by arguing that "reducing relative twist in the device of Rothamel would provide stability to the drum during periods of extremely high rotational velocity". The Examiner, however, does not point to any teaching as to how one would reduce the relative twist in the drum during the operation of the encoder given an observed relative twist. Furthermore, the Examiner has not pointed to any suggestion in Rothamel that the operation of the device taught therein involves extremely high rotational velocities. Finally, motion at extremely high rotational velocities would not necessarily cause any twist instabilities. Such instabilities might result from high

accelerations, or rotational velocity gradients, not from constant rotational velocities, whether low or high.

Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 7.

6. Rejection of Claim 8 under 35 U.S.C. 103(a) as being unpatentable over Rothamel in view of Karim-Panahi and Cohen

Claim 8 depends from Claim 7 and further requires that the stripes on the second track have widths that are different from the stripes on the first track. The Examiner admits that the track taught in Karim-Panahi does not have this property. The Examiner looks to Cohen as providing the missing teachings.

First, Applicant repeats the arguments made above with respect to the missing teachings in the combination of Rothamel and Karim-Panahi with respect to Claim 1 from which Claim 8 also depends. Cohen does not provide the missing teachings.

Second, Applicant maintains that the use of reflective stripes of different widths, as taught by Cohen ('839), would offer no benefit in the device taught by Karim-Panahi. Applicant points out that, as noted above with respect to Claim 7, the purpose of the device taught by Karim-Panahi is to detect axial distortion along a rotating shaft. Karim-Panahi teaches the use of two axially separated tracks of reflectors to generate two different trains of pulses whose relative phase shift is indicative of shaft distortion. Applicant submits that no additional information of any value to the measurement of distortion would be gained if the two separated tracks of reflectors were to have stripes of different widths.

Third, Applicant submits that the use of tracks having different track widths in the device of Karim-Panahi would actually degrade device performance and is contrary to the teachings of Karim-Panahi. The reference specifically teaches that in the absence torsional displacement, time sequences of the two channels overlap. If the two tracks have different spacings, the signals will not overlap at any relative displacement of the tracks.

The Examiner points to the passage at col. 4, lines 2-5 as stating that the marks on the tracks could be of unequal spacing and that the marks on one track do not need to lineup with their counterparts on the other track. This passage does not imply that the tracks do not have identical sequences of marks. In this regard, the passage refers to the marks on one track having counterparts on the other track. If there were different numbers of marks on the tracks, each mark could not have a counterpart on the other track.

Finally, the apparatus of Karim-Panahi operates by measuring the phase difference between the two channels. A phase difference between two signals is the amount by which one signal must be shifted to bring it into alignment with the other signal such that the signals match. If the two tracks have different spacing, there is no shift that brings about alignment. The Examiner has not pointed to any teaching in the art of any mechanism for measuring the phase difference of two signals that do not match when shifted.

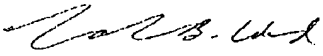
Accordingly, Applicant submits that the Examiner has not made a *prima facie* case for obviousness with respect to Claim 8.

VIII. CONCLUSION

Appellant respectfully submits that for the reasons of fact and law argued herein, the decision of the Examiner in finally rejecting Claims 1-8 should be reversed.

I hereby certify that this paper (along with any others attached hereto) is being sent via facsimile to fax number: 571-273-8300

Respectfully Submitted,



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APPENDIX

THE CLAIMS ON APPEAL:

1. An encoder comprising:

a drum comprising a circular cylindrical surface characterized by an axis and a radius of curvature, said drum having a surface with a normal perpendicular to said axis;

a first track comprising a plurality of alternating reflective and non-reflective stripes arranged on said circular cylindrical surface, said reflective stripes comprising a portion of a said circular cylindrical surface, each reflective stripe having a circular cylindrical outer surface having an axis coincident with said axis of said drum;

a first light source that illuminates said outer surface of said reflective stripes at an oblique angle relative to said normal; and

a first photodetector positioned to receive light from said light source that is reflected from said reflective stripes of said first track when said drum moves relative to said photodetector, an image of said reflective stripes of said first track being formed on said first photodetector, said image having a magnification that depends on said radius of curvature.

2. An encoder comprising:

a drum comprising a circular cylindrical surface characterized by an axis, said drum having a surface with a normal perpendicular to said axis;

a first track comprising a plurality of alternating reflective and non-reflective stripes arranged on said circular cylindrical surface, said reflective stripes comprising a portion of a said circular cylindrical surface;

a first light source that illuminates said stripes at an oblique angle relative to said normal; and

a first photodetector positioned to receive light from said light source that is reflected from said reflective stripes of said first track when said drum moves relative to said photodetector, an image of said reflective stripes of said first track being formed on said first photodetector, and having a magnification that depends on said radius of curvature,

wherein said first light source emits a collimated beam of light.

3. The encoder of Claim 1 wherein said drum rotates about said axis when a shaft is rotated.

4. The encoder of Claim 3 wherein said shaft is coincident with said axis.

5. The encoder of Claim 1 wherein said circular cylindrical surface lies between said first track and said axis.

6. The encoder of Claim 1 wherein said first track lies between said circular cylindrical surface and said axis.

7. The encoder of Claim 1 further comprising:

a second track comprising a plurality of alternating reflective and non-reflective stripes arranged on said circular cylindrical surface;

a second light source for illuminating said stripes of said second track at an oblique angle relative to said normal; and

a second photodetector positioned to receive light from said second light source that is reflected from said reflective stripes of said second track, wherein said drum moves relative to said second photodetector.

8. The encoder of Claim 7, wherein said reflective stripes of said second track have widths that are different from said reflective stripes of said first track.

Evidence Appendix

none

Related Proceedings Appendix

none